

AMENDMENT AND RESPONSE

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Filing Date: July 31, 2001

Title: CARDIAC RHYTHM MANAGEMENT SYSTEM FOR EDEMA

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indicator, and coupled to the energy delivery circuit to provide a control signal for timing delivery of the electrical energy to the subject, the controller including a cardiac resynchronization therapy parameter and a cardiac contractility modulation therapy mode, and in which the controller is configured to initiate/adjust, in response to the detected edema indicator, at least one of the cardiac resynchronization therapy that coordinates a spatial nature of a depolarization associated with a heart contraction in at least one heart chamber and the cardiac contractility modulation therapy that includes delivering electrical energy to a portion of a heart during a refractory time period of the portion of the heart.

Please add the following new claims 30 - 50.

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30. (New) A method including:  
sensing, in a subject, a condition correlative to edema, the sensing including detecting a decrease in the baseline thoracic impedance associated with fluid buildup in the portion of the thorax of the subject, in which the baseline portion of the thoracic impedance is less than or equal to a cutoff frequency value that is between 0.01 Hz and 0.5 Hz inclusive; and  
initiating/adjusting, in response to the sensing, at least one of a cardiac resynchronization therapy and a cardiac contractility modulation therapy.
31. (New) The method of claim 30, in which the cutoff frequency value is approximately 0.1 Hz.
32. (New) A method including:  
sensing, in a subject, a condition correlative to edema, the sensing including detecting a change in a baseline thoracic impedance associated with fluid buildup in a portion of a thorax of the subject, and in which the sensing also includes detecting an increase in a rate of breathing of the subject from a portion of the thoracic impedance that is approximately between 0.05 Hz and 2.0 Hz inclusive; and  
initiating/adjusting, in response to the sensing, at least one of a cardiac resynchronization
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therapy and a cardiac contractility modulation therapy.

33. (New) A method including:

sensing, in a subject, a condition correlative to edema; and

initiating/adjusting, in response to the sensing, a cardiac resynchronization therapy that includes selecting an interelectrode delay value, for subsequent delivery of contraction-evoking stimulations occurring during a single cardiac cycle.

34. (New) A method including:

sensing, in a subject, a condition correlative to edema; and

initiating/adjusting, in response to the sensing, a cardiac resynchronization therapy that includes selecting at least one particular electrode, from a plurality of electrodes differently located in association with a heart of the subject, for subsequent delivery of a contraction-evoking stimulation.

35. (New) The method of claim 34, in which selecting the interelectrode delay value includes selecting at least one of an atrioventricular delay value, an interventricular delay value, and an intraventricular delay value.

36. (New) The method of claim 34, in which the selecting the particular electrode includes selecting the particular electrode from a plurality of same-chamber electrodes differently located in association with a single chamber of the subject's heart.

37. (New) The method of claim 34, in which the selecting the particular electrode includes selecting the particular electrode from a plurality of electrodes, at least two of which are located in association with different chambers of the subject's heart.

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38. (New) A method including:

sensing, in a subject, a condition correlative to edema; and

initiating/adjusting, in response to the sensing, a cardiac contractility modulation therapy that includes providing a non-contraction-evoking stimulus to a location of a heart of the subject during a refractory period of the heart location.

39. (New) The method of claim 38, in which the refractory period follows a paced or sensed contraction of the heart location.

40. (New) A cardiac rhythm management system including:

an edema detection circuit to sense a condition correlative to edema in a subject, the edema detection circuit including a thoracic impedance detection circuit configured to be coupled to first and second electrodes configured for association with a portion of the subject's thorax, the thoracic impedance detection circuit including an averager/lowpass filter to obtain a baseline portion of the thoracic impedance signal associated with the condition correlative to edema, the averager/lowpass filter including an effective cutoff frequency that is between 0.01 Hz and 0.5 Hz;

an electrical energy delivery circuit to deliver electrical energy to the subject; and

a controller circuit, coupled to the edema detection circuit to receive a detected edema indicator, and coupled to the energy delivery circuit to provide a control signal for timing delivery of the electrical energy to the subject, the controller including a cardiac resynchronization therapy parameter and a cardiac contractility modulation therapy mode, and in which the controller is configured to initiate/adjust, in response to the detected edema indicator, at least one of the cardiac resynchronization therapy and the cardiac contractility modulation therapy.

41. (New) The system of claim 40, in which the cutoff frequency is approximately equal to 0.1 Hz.

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42. (New) The system of claim 40, in which the thoracic impedance circuit further includes a filter circuit to obtain information about the subject's breathing.

43. (New) The system of claim 40, in which the edema detection circuit provides the condition correlative to edema as determined from both a breathing rate of a subject and a thoracic impedance indication of fluid buildup in the subject's thorax.

44. (New) A cardiac rhythm management system including:  
an edema detection circuit to sense a condition correlative to edema in a subject;  
an electrical energy delivery circuit to deliver electrical energy to the subject; and  
a controller circuit, coupled to the edema detection circuit to receive a detected edema indicator, and coupled to the energy delivery circuit to provide a control signal for timing delivery of the electrical energy to the subject, the controller including a cardiac resynchronization therapy parameter and a stored interelectrode delay, and in which the controller is configured to initiate/adjust, in response to the detected edema indicator, the cardiac resynchronization therapy by adjusting a value of the interelectrode delay.

45. (New) The system of claim 44, in which the interelectrode delay includes at least one of an atrioventricular delay, an interventricular delay, and an intraventricular delay.

46. (New) A cardiac rhythm management system including:  
an edema detection circuit to sense a condition correlative to edema in a subject;  
an electrical energy delivery circuit to deliver electrical energy to the subject; and  
a controller circuit, coupled to the edema detection circuit to receive a detected edema indicator, and coupled to the energy delivery circuit to provide a control signal for timing delivery of the electrical energy to the subject, the controller including a cardiac resynchronization therapy parameter, and in which the controller is configured to initiate/adjust, in response to the detected edema indicator, the cardiac resynchronization therapy by selecting at least one particular electrode, from a plurality of electrodes differently located in association with

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a heart of the subject, for subsequent delivery of a contraction-evoking stimulation.

47. (New) The system of claim 46, in which the controller, in response to the detected edema indicator, selects the particular electrode from a plurality of same-chamber electrodes differently located in association with a single chamber of the subject's heart.

48. (New) The system of claim 46, in which the controller, in response to the detected edema indicator, selects the particular electrode from a plurality of electrodes, at least two of which are located in association with different chambers of the subject's heart.

49. (New) A cardiac rhythm management system including:  
an edema detection circuit to sense a condition correlative to edema in a subject;  
an electrical energy delivery circuit to deliver electrical energy to the subject; and  
a controller circuit, coupled to the edema detection circuit to receive a detected edema indicator, and coupled to the energy delivery circuit to provide a control signal for timing delivery of the electrical energy to the subject, the controller including a cardiac contractility modulation therapy mode, and in which the controller is configured to initiate/adjust, in response to the detected edema indicator, the cardiac contractility modulation therapy by providing a non-contraction-evoking stimulus to a location of a heart of the subject during a refractory period of the heart location.

50. (New) The system of claim 49, in which the refractory period follows a paced or sensed contraction of the heart location.

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**Clean Version of the Amended Claims**

**CARDIAC RHYTHM MANAGEMENT SYSTEM FOR EDEMA**

Applicant: Qingsheng Zhu et al.

Serial No.: 09/919,483

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**Please replace claims 1 and 15 with their respective claims, as amended, below:**

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1. (Amended) A method including:  
sensing, in a subject, a condition correlative to edema; and  
initiating/adjusting, in response to the sensing, at least one of a cardiac resynchronization therapy that coordinates a spatial nature of a depolarization associated with a heart contraction in at least one heart chamber and a cardiac contractility modulation therapy that includes delivering electrical energy to a portion of a heart during a refractory time period of the portion of the heart.

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15. (Amended) A cardiac rhythm management system including:  
an edema detection circuit to sense a condition correlative to edema in a subject;  
an electrical energy delivery circuit to deliver electrical energy to the subject; and  
a controller circuit, coupled to the edema detection circuit to receive a detected edema indicator, and coupled to the energy delivery circuit to provide a control signal for timing delivery of the electrical energy to the subject, the controller including a cardiac resynchronization therapy parameter and a cardiac contractility modulation therapy mode, and in which the controller is configured to initiate/adjust, in response to the detected edema indicator, at least one of the cardiac resynchronization therapy that coordinates a spatial nature of a depolarization associated with a heart contraction in at least one heart chamber and the cardiac contractility modulation therapy that includes delivering electrical energy to a portion of a heart during a refractory time period of the portion of the heart.

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